Specific Heat Capacity:

Honors Chemistry Lab # 4

Introduction

As we continue our unit on kinds and properties of matter, we’re going to examine a property called specific heat capacity. Just like density, it’s unique to a substance and can be used to identify a substance. Specific heat measures how much energy a substance must absorb to get hotter (I mean warmer). Some substances have high specific heat and some have low specific heat. What does it tell us about a substance if this number is high or low? Why do some substances have high specific heat while others have a low one? What kinds of substances have high specific heat and what kinds have low specific heat?

The unit for specific heat capacity involves the two properties we used in the density lab: mass and volume, along with heat. Do you know the units for these three properties? Find out before you start the lab!

These are the questions we will need to answer by the end of this lab.

**Materials**:

400-600mL Beaker

Beaker Tongs

Electronic Balance

Graduated Cylinder

Styrofoam cup

Thermometer

Bunsen Burner, Ring stand and ring

Metal Cubes

Prepared Data Table

**SAFETY**: Be sure to wear an apron and goggles throughout this lab.

Procedure: Make sure you read through and understand the procedure the night before you do this lab.

This lab procedure will be demonstrated in class. You will need to be very careful and reproduce what your teacher does exactly to get good results.

**Procedure**: (Hint: Be Efficient in this lab, while one metal is heating, mass the next one, while one is in the Styrofoam, put the next one in the 100C water.)

1. Set up water bath using the set up shown in class. Heat the water until its temperature measures 100oC. This may take some time (why?) So, start on step two as soon as this is started.

2. Measure the mass of your metals. You will need to share metals with other groups so make sure you keep track of which cube you are using.

3. When the water at 100C, hang your first metal from the clamp into the water. Make sure that the metal is completely submerged in the water.

4. Keep the cube in the water for 5 minutes.

5. When the water starts to boil, measure the temperature of the water. Make sure that the thermometer does not touch the metal.

6. While the metal is in the water, add 100mL of cold water to the Styrofoam cup.

Have this and your tongs ready for the hot metal!

7. When the metal is ready, you’ll need to move quickly and safely. Both members of your team will need to work together.

8. Take the temperature of the cold water right before you add the metal.

9. Keep the thermometer in the cup and quickly put the metal into the Styrofoam cup. Don’t touch the metal to the cup or the thermometer!

10. Take the temperature of the water in the Styrofoam cup while the hot metal cube is in the cup. Record the highest temperature of this water. It may take a minute or two.

11. Repeat this procedure for all four metals.

Analysis:

1. Make a data table that looks like this for all four metals

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Metal | Mass(g) | Tempi  Hot Water Temp | Tempi  Cold Water in cup | Tempf  Water in cup at end | Specific Heat Exp | Specific Heat Theoretical | Percent  Error |
| Steel |  |  |  |  |  |  |  |
| Etc |  |  |  |  |  |  |  |

2. Answer the questions asked in the introduction of this lab sheet

3. Graph the specific heat capacity of these metals vs. the density.

4. What correlation do you notice between these two properties?

5. What would you predict about the specific heat capacity of the glass and rubber from the density lab?

6. If 50g of steel that had a temperature of 100C is placed in 50g of water with a temperature of 0C, why doesn’t the temperature of the cold water end up at 50C?

Conclusion: Write a short 3-5 sentence conclusion stating the general results of this lab.